

## PROTECTIVE GARMENT

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### BACKGROUND

**[0001]** The present invention relates generally and in various embodiments to garments. More specifically, the present invention relates generally and in various embodiments to garments worn to protect the wearer from splinters and abrasions resulting from sliding down, for example, a wooden utility pole.

**[0002]** Although various implementations of the present invention, among many, may be described herein with reference to the specific illustrative embodiments related to particular applications, those skilled in the art will understand that the invention is not in any way intended to be, nor should be, limited to such embodiments and/or applications. Those having ordinary skill in the art and reference to the description of the embodiments disclosed and described herein will recognize that additional modifications, applications, and other embodiments may fall within the scope of the claimed invention, and that there may be additional fields in which the present invention may be practiced.

**[0003]** It can be appreciated that commercial entities and other organizations that employ workers in elevated environments are aware of the potential risks attendant upon work performed in such environments. In view of this awareness, commercial entities and other organizations devote time and resources to promoting the safety of workers performing work in elevated environments to make the performance of work as safe as possible. Promoting safety of workers in elevated environments may involve instituting training programs and/or providing workers with a variety of support devices, support

systems, backup devices and systems, and/or other means that promote the stability and safety of workers in elevated environments. Despite the best efforts of an organization to enhance the safety of its workers and reduce the risk of falling from elevated structures, for example, it is nonetheless difficult to eliminate all risks to workers performing work on such elevated structures.

**[0004]** Redundant systems for promoting safety of workers on elevated utility structures may thus sometimes be used. Such redundant systems can sometimes be beneficial in addition to the myriad of existing support systems, methods, devices and/or other apparatus employed by workers on elevated structures to reduce or mitigate risks associated with falling from utility structures, for example.

**[0005]** Climbing utility structures such as wooden utility poles to a certain height is an essential function of some workers employed by, for example, a telecommunications company. These workers regularly climb wooden utility poles as part of their normal work duty in order to install and repair telephone service, for example. The workers use specialized climbing gear such as gaff hooks attached to their climbing boots to assist them in climbing the wooden utility poles. The gaff hooks are designed to dig into the wood and allow the worker to propel their body straight up in a vertical direction. The gaffs must remain dug into the wood to prevent the worker from falling off the pole. To assist the worker in ascending or descending a pole and to provide a measure of safety, often times they wears a safety belt around their waist attached to their hips and strapped around the pole to assist them in climbing the pole. While ascending a wooden utility pole and working at an elevated environment the worker should generally maintain physical contact with the pole with at least three out of the four limbs (right arm, left arm, right leg and left leg).

[0006] Despite the use of specialized climbing equipment such as gaffs, safety belts, and other safety devices, from time-to-time workers lose control of the pole while gaff climbing and begin to descend from the pole. While descending, workers tend to grasp or hug the wooden utility pole.

## SUMMARY

In one general respect, embodiments of the present invention are directed to a garment suitable to be worn on an upper body portion of a person. The garment includes a base fabric having a front portion and a rear portion formed with openings for the person's arms and head and having a breast portion on the front portion; and a first protective panel attached to the breast portion of the base fabric; wherein the first protective panel is adapted to protect the upper body portion of the person during descent from a vertical surface.

[0007] According to various embodiments, the present invention is directed to a garment suitable to be worn on a lower arm portion of a person. The garment includes a base fabric having an elongated portion with an opening suitable receiving a person's arm; and a hand portion attached to the elongated portion; wherein the hand portion comprises a first protective panel attached thereto; wherein the first protective panel is adapted to protect the upper body portion of the person during descent from a vertical surface.

[0008] Other apparatuses, systems, and/or methods according to embodiments of the present invention will be or become apparent to one with skill in the art upon examination of the following drawings and detailed description. It is intended that all such additional apparatuses, systems, and/or methods be included within this description, be within the scope of the present invention, and be protected by the accompanying claims.

## DESCRIPTION OF THE DRAWINGS

[0009] Embodiments of the present invention are described herein in conjunction with the following figures, wherein:

Figure 1 illustrates a protective garment according to various embodiments of the present invention;

Figure 2 illustrates another protective garment according to various embodiments of the present invention;

Figures 3A, B illustrate another protective garment according to various embodiments of the present invention;

Figure 4 illustrates a protective panel according to various embodiments of the present invention;

Figure 5 illustrates another protective garment according to various embodiments of the present invention; and

Figure 6 illustrates another protective garment according to various embodiments of the present invention.

## DESCRIPTION

[0010] It is to be understood that the figures and descriptions of the various embodiments of present invention described herein, among others, have been simplified to illustrate representative elements of protective garments that may be used when a person descends, for example, a wooden utility pole. The representative elements are relevant for a clear understanding of the present invention, while, for purposes of clarity, other specific elements of the protective garments are not described herein as that would not facilitate a better or clearer understanding of the present invention. Those of ordinary

skill in the art will appreciate, however, that these and other elements may be found in conventional garments and may be readily understood.

[0011] Turning now to Figure 1, various embodiments of the present invention described herein, among others, are generally directed to a protective garment 10 suitable to be worn on the upper part of a human body. The garment 10 has a collar 11, sleeves 16, and front opening 13. The protective garment 10 may be worn by a person while working in an elevated environment on, for example, a wooden or steel utility pole or other surface or while ascending or descending the surface. The protective garment 10 according to various embodiments of the present invention may comprise lightweight penetration resistant protective panels 12 stitched, sewn, laminated, or otherwise attached to breast portions 14 of the protective garment 10. The protective garment 10 also may comprise forearm portions or sleeves 16 that may include additional protective panels 12. The sleeved protective garment 10 may comprise coats, jackets, shirts, and the like.

[0012] Figure 2 illustrates various embodiments of a sleeveless protective garment 20. The protective garment 20 is suitable to be worn on the upper part of a human body and may include a collar 21 and a front opening 23. The sleeveless protective garment 20 also may comprise the protective panels 12 in the breast portion 22. The sleeveless protective garment 20 may include vests that may be worn in various types of temperature environments.

[0013] In various embodiments of the present invention, the protective garment 10, 20 may be constructed of a flexible base garment comprising the splinter and abrasion resistant protective panels 12. The protective garment 10, 20 may be constructed of a lightweight, stretchable, breathable, and comfortable fabric to accommodate the environmental conditions encountered by the workers. For example, to accommodate colder working environments the base garment may be constructed of heavier materials

such as cotton, wool, polyester/wool blend, polyester/cotton blend and other similar heavier materials. The heavier material also may include some form of heat insulating material. In warmer working environments the protective garment 10, 20 may be constructed of lightweight porous materials. Suitable materials for the base garment may give or stretch to a certain degree to aid in the wearer's comfort.

**[0014]** In various embodiments of the present invention, the flexible protective garment 10, 20 may be formed of a plurality of conventional fibers such as cotton, polyester, nylon, and any blends thereof. The protective garment 10, 20 also may be formed of a lightweight fabric, coated fabric, and/or fabric/laminate that is lightweight, waterproof, windproof, and breathable such as GORE-TEX® fabric, for example. The protective garment 10, 20 also may comprise a nylon outer shell fabric that is laminated to a waterproof, windproof, breathable membrane such as a GORE-TEX® membrane, for example. The protective garment 10, 20 also may comprise a two-ply nylon shell GORE-TEX® fabric. The protective garment 10, 20 also may comprise lightweight breathable features for higher temperature climates as well as insulated features for colder temperature climates such as a quilted lining with fiberfill insulation, for example.

**[0015]** Figure 3A illustrates various embodiments of a protective garment in the form of a glove 30. The glove 30 may include, for example, a first hand portion 32 comprised of the same protective material that the protective panels 12 are constructed from. The glove 30 also may include a second forearm portion 34 attached to the hand portion 32. The forearm portion 34 also may include a protective panel 12 to protect the wearer from injuries due to splinters and abrasion. The hand portion 32 of the glove 32 may be constructed of a stretchable flexible material while the forearm portion 34 may be constructed of a more durable material.

[0016] Figure 3B illustrates another embodiment of a protective garment in the form of a glove 36 with open fingertips for added flexibility, dexterity and to minimize weight and energy retention. The glove 36 also may include, for example, a first hand portion 38 comprised of the same protective material that the protective panels 12 are constructed out of. The glove 36 also may include the forearm portion 34 attached to the hand portion 38. The forearm portion 34 also may include a protective panel 12 to protect the wearer from injuries due to splinters and abrasion. The hand portion 38 of the glove 36 may be constructed of a stretchable flexible material while the forearm portion 34 may be constructed of a more durable material.

[0017] In various embodiments of the present invention, the protective panels 12 may be formed of a flexible lightweight heavy-duty penetration resistant material suitable for protecting the wearer against abrasion and splinters while falling from a utility pole with arms around the pole. In various embodiments of the present invention the protective panels 12 may be constructed of a thin, lightweight, low friction, flexible, and smooth material so that they are comfortable to the wearer of the protective garment 10, 20 and do not hinder the wearer's freedom of movement. The protective panel 10, 20 material also may be thin and porous to accommodate workers in higher temperature environments.

[0018] Turning now to Figure 4, in various embodiments of the present invention the protective panels 10, 20 may be formed of single (mono-layer) or multi-layer high performance natural or synthetic materials that are lightweight, strong, and heat-resistant. For example, the protective panels 12 may be formed using a single ply 40 or multiple plies 42 of fabric woven from any of the aramid high performance fibers listed above. The protective panels 12 may be formed of one to thirty-two plies, for example. In various embodiments of the present invention, the protective panels also may be formed of 3 or 4 plies, for example. Some synthetic aromatic polyamide materials that may be

fashioned into high tenacity fibers, filaments, or sheets and used in textiles also may be used to form the protective panels 12. One such class of synthetic fibers that may be suitable for making the protective panels 12 is commonly referred to as aramid fiber. Fabrics made from high performance aramid fibers may be suitable for fashioning the protective panels 12 that are splinter and abrasion resistant. There are many commercially available high performance aramid fibers that may be used to weave fabrics suitable for making splinter and abrasion resistant protective panels 12. Any type of fiber, including those not mentioned herein, may be used to make the protective panels 12 according to various embodiments of the present invention. As discussed previously, the protective panels 12, whether formed of the single ply layer 40 or the multiple ply layer 42, may be attached to a base fabric 44 of which the protective garment 10, 20 is constructed. The individual single ply layers 40 in the multiple ply layer 42 fabric may be attached to each other by, for example, laminating, stitching, sewing, and other suitable means of attachment. The protective panels 12 also may be stitched, sewn, laminated, or attached to the base fabric 44 using any suitable means.

[0019] As discussed previously, the base fabric may be formed of a plurality of conventional fibers such as cotton, polyester, nylon, and any blends thereof. The base fabric 44 also may be formed of a lightweight fabric, coated fabric, and/or fabric/laminate that is lightweight, waterproof, windproof, and breathable such as GORE-TEX® fabric, for example. Base fabric 44 also may comprise a nylon outer shell fabric that is laminated to a waterproof, windproof, breathable membrane such as a GORE-TEX® membrane, for example. The base fabric 44 also may comprise a two-ply nylon shell GORE-TEX® fabric.

[0020] Examples of high performance aramid fibers that may be suitable for weaving fabrics for making the protective panels 12 include, but are not limited to Kevlar®, an organic fiber produced by the DuPont Corporation, which is a light

structural fiber that provides impact resistance. One type of Kevlar® fabric that may be suitable for constructing the protective panels 12 according to one of many embodiments of the present invention includes a style 779 aramid high performance fabric available from Hexcel Schwebel. The 779 aramid fabric comprises a Kevlar® 159 yarn that is 200 denier mesh. The fabric weighs 3.9 oz/yd<sup>2</sup> and is of plain weave style. The nominal construction of the style 779 fabric comprises a warp count and fill count of 70 yarns/inch. The fabric may have a thickness of 6.0 to 8.0 mils, a breaking strength of 385 lbf/in and is suitable for safety and personal protection applications. The Kevlar® protective panels 12 will not burn although they may melt at 900° F. Also, the Kevlar® protective panels 12 may be treated to make them water repellent.

[0021] The protective panels 12 also may be made from fabrics woven from other fibers such as, for example, Twaron®, a high strength fiber made from aramid polymer supplied by Accordis. This fiber is similar to Kevlar® and is a useful material for reinforcement and splinter and abrasion resistance applications. Yet another fiber that may be used to weave fabrics for making the protective panels 12 includes Spectra®, which is an ultra lightweight, high strength polyethylene fiber developed by Honeywell International Corporation. Spectra® fibers provide high damage tolerance and flexibility. Another fiber that may be used to weave the fabric to make the panels is Zylon®, which consists of a rigid chain of molecules of ploy (p-phenylene-2, 6-benzobisoxazole)(PBO). This fiber is available from Toyobo.

[0022] Figure 5 illustrates various embodiments of a protective garment 50 suitable to be worn on the upper part of a human body having a collar 51, sleeves 54, and front opening 53. The protective garment 50 includes the protective panels 12 in the breast portion 52 as well as the forearm/sleeve portion 54. The protective garment 50 also may include a variety of pockets 56, 58 designed to hold items that may be useful to a worker while working in elevated environments such as up on a utility pole. The

protective garment 50 also may include carry loops 60 that may be useful for carrying additional tools up on the utility pole. The variety of useful items may include, for example, wire connectors, wire, tone probe, pullers, and safety related items and equipment. The pockets 56, 58 and loops 60 also may be useful for carrying hardware such as "J" and "P" hooks, hammers, powder drivers, meters, small blocks, cable clamps, drop wire clamps, strand connectors, dead end wire, earmuffs, flashlights, safety and sunglasses, gloves, hat liners, nut drivers, bridle rings, tags, and screws. The protective garment 50 also may include attachable and detachable structural members 62 that are designed to secure the bottom of the protective garment 50 to the worker's climbing safety belt to minimize the likelihood of the protective panels 12 rising up the worker's body while descending and hugging a pole. The attachable and detachable structural members 62 may include for example loops, buttons, snaps hooks, and hook and loop fasteners such as Velcro®, for example, and other suitable means for attaching and detaching the protective garment 50 to the safety belt.

**[0023]** Figure 6 illustrates various embodiments of a sleeveless protective garment 64 that is similar to the protective garment 50 shown in Figure 5 except for the sleeves. The protective garment 64 may be suitable to be worn on the upper part of a human body and may include a collar 61 and a front opening 63. The sleeveless protective garment 64 also may comprise the protective panels 12 in the breast portion 66. The sleeveless protective garment 64 may include vests that may be worn in various types of temperature environments. The sleeveless protective garment 64 also may include a variety of pockets 56, 58 and loops 60 for carrying useful items and also includes the attachable and detachable structural members 62 to secure the bottom of the protective garment 60 to the worker's climbing safety belt.

**[0024]** Although the present invention has been described with regard to certain embodiments, those of ordinary skill in the art will recognize that many modifications

and variations of the present invention may be implemented. The foregoing description and the following claims are intended to cover all such modifications and variations. Furthermore, the components and processes disclosed are illustrative, but are not exhaustive. Other components and processes also may be used to make systems and methods embodying the present invention.